City of Toronto's Green Bin Program & its AD Facilities: Project Design, Construction and Operation

Digesting Urban Organic Residuals Forum
May 30, 2012

AECOM

Overview

- Overview of Toronto SWM Programs
- Background - Green Bin Organics Program
- Background - Dufferin AD Facility
- Future expansion of AD capacity
- Biogas utilization

About Toronto - Statistics

- Capital of Ontario
- Population 2.5 million
- 510,000 single-family homes
- 500,000 apts., condos etc. (and growing)
- Part of Greater Toronto Area, Population ~ 8 million
- Managed Wastes (2009):
  - Total - 933,052 MT/yr
  - Organics (SSO) - 111,116 MT/yr (11.9%)
  - Leave & Yard W. - 95,777 MT/yr (10.3%)

* Metric tons per year

Sources: City of Toronto

Curbside Residential Program - Three Stream Collection

Three "Core" Streams

- Single-stream Recycling (bi-weekly)
- Green Bin (weekly)
- Residual (bi-weekly)

"Specialty" Streams

- Yard + Garden Waste (seasonal; bi-weekly)
- Household Durable Goods (bi-weekly)
- White Goods – by Appointment
- Household Hazardous Waste

Sources: City of Toronto

Toronto's Green Bin Program – Facts & Figures

- Part of City's "Target 70" goal (70% waste diversion from LF)
- **Objective:** maximize recovery of source separated organics (SSO) through:
  - User convenience (kitchen & green bins provided)
  - Allow use of regular plastic bagging (difficult for composting)
  - Green Bin Collection (weekly)
  - Bi-weekly residual waste collection to encourage diversion
- NO yard waste accepted (collected separately)

Accepted Material:

- fruits
- meat, shellfish, fish products
- pasta, bread, cereal
- dairy products, egg shells
- coffee grounds, filters, tea bags
- soiled paper towels, tissues
- soiled paper food packaging: fast food paper packaging, ice cream boxes, muffin paper, flour and sugar bags
- paper coffee cups, paper plates
- household plants, including soil
- diapers, sanitary products
- animal waste, bedding (e.g. from bird/hamster cages), kitty litter
- pet food

TORONTO

Sources: City of Toronto

Toronto's Green Bin Program - Collection

Sources: City of Toronto; CCI; AECOM

Organic Solid Waste & Anaerobic Digestion

Challenge

Organic solid waste (source separated organics or the organic fraction of MSW) is inhomogeneous and contains impurities

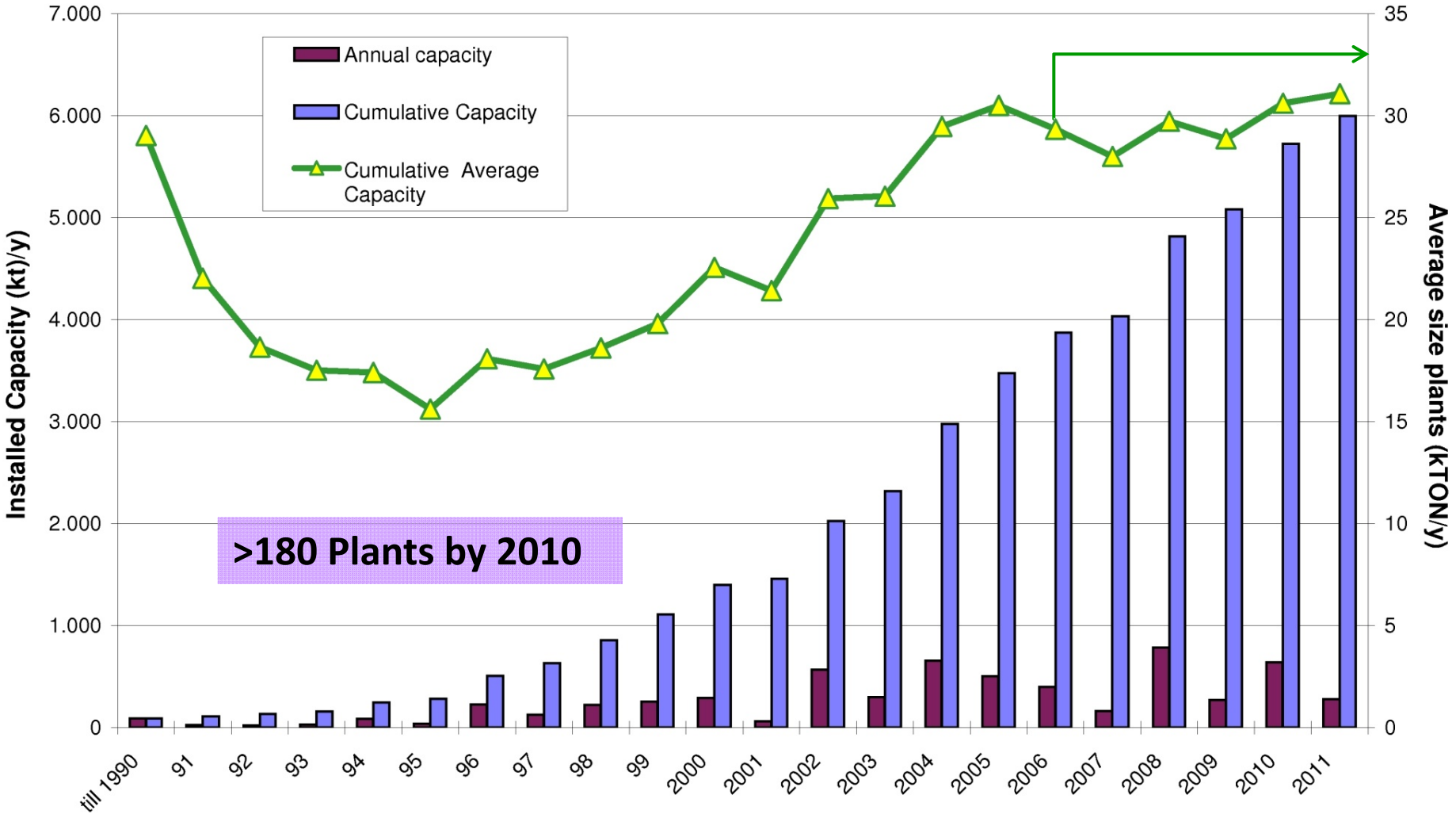
(e.g. plastic bags, textiles, cardboard, stones, grit, bones, shells, glass, metals, batteries) requiring pre-treatment prior to digestion.

Solution

Application of a ”Pre- and/or Post-Treatment Process” for effective removal of contaminants & homogenization.

Sources: AECOM

AD Plant Capacity of SSO and OFMSW in Europe



Source: De Beare, L.; Mattheeuws, B. (2010); adapted

City of Toronto's Green Bin Program
Dufferin AD Demonstration Plant w/ 'wet' BTA Process

Start-up: 2002

Capacity: 25,000 MT/yr SSO (design);
40,000+ MT/yr (2011)

Setup: City owned; contractor operated

AD Process: "Wet" BTA

- Complete mixed (w/digester gas)
- Single stage, Mesophilic

* Metric tons per year

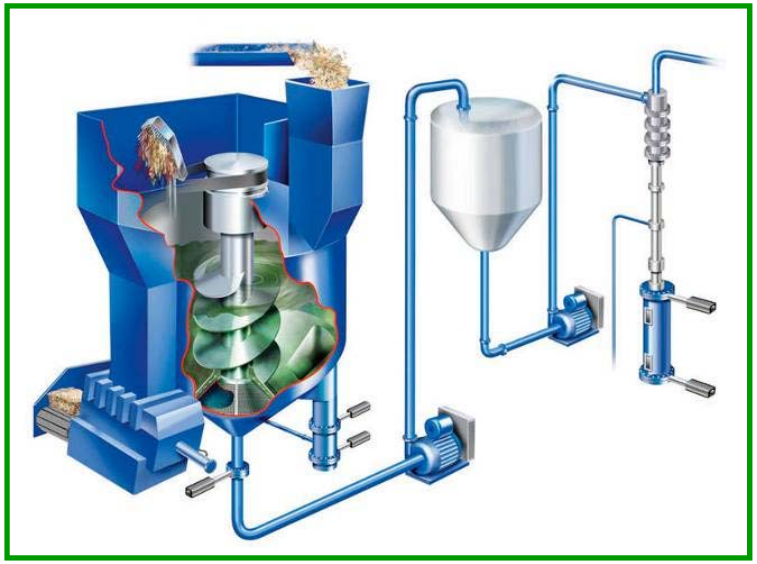
Sources: City of Toronto; CCI; BTA International

The BTA Process at the Dufferin AD Plant

Hydropulper

Grit Removal System

Inside the pulper



Organic waste slurry
to be fed into the digester

Sources: BTA International; City of Toronto

The BTA Process at the Dufferin AD Plant
Pre-treatment – Removed Contaminants

Hydropulper

Stones, glass, metal…

Plastics, textiles, wood…

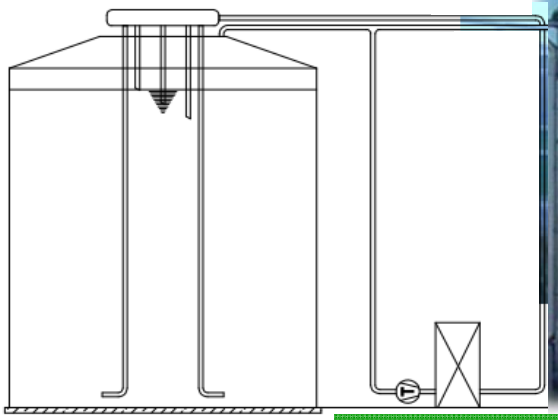
Grit Removal System (w/Hydrocyclone)

Tiny pieces of sand & grit

Source: BTA International

The BTA Process at the Dufferin AD Plant
Digestion – Heating and Mixing

- Complete mixed w/digester gas)
- Single stage)
- Mesophilic (35 – 38°C)
- Intermittent feeding (weekday only)
- Feed: 8-10% TS
- Solids Recycling
  - 15 d HRT
  - 25 d SRT



Digester Design

Gas Lances

Gas Compressors

Tube Heat Exchangers

Source: BTA International

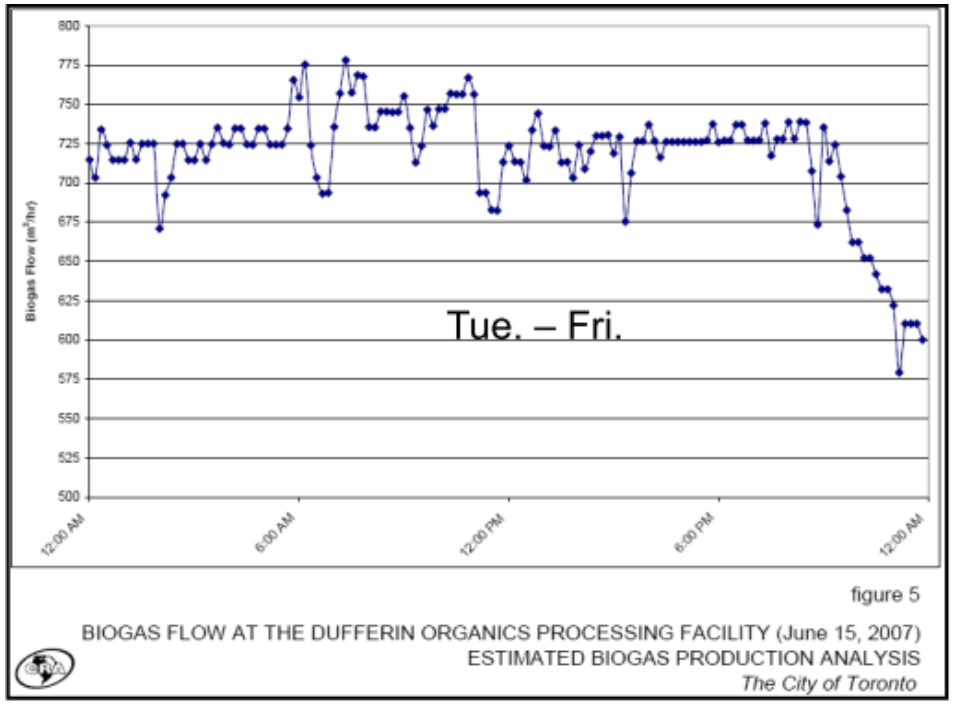
Dufferin AD Plant - Operational Experience

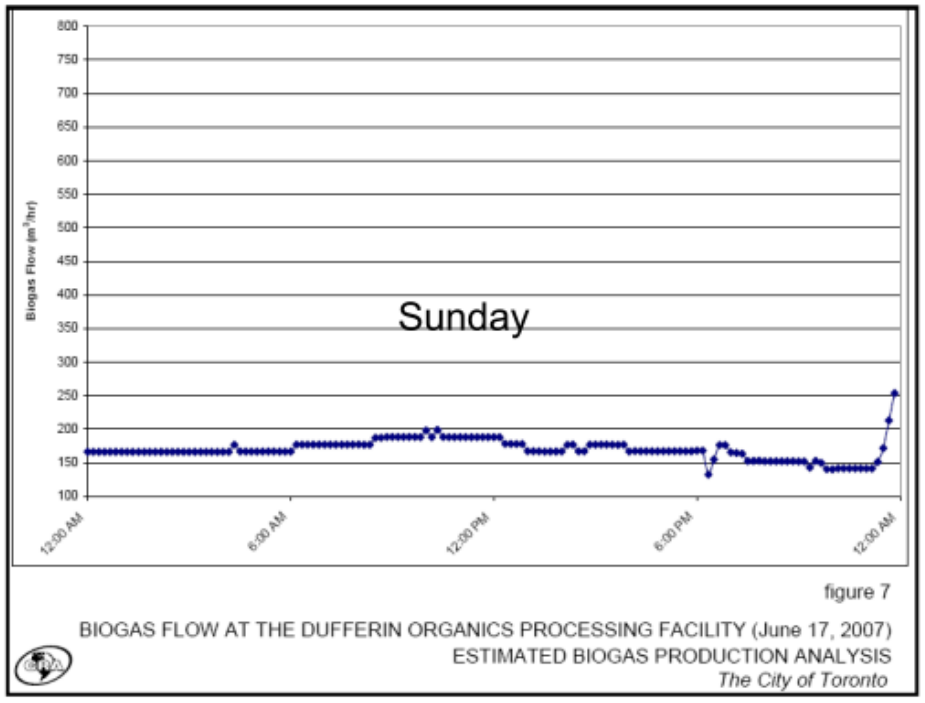
Dufferin AD Facility Performance Summary	2004		2007		2010	
	tonnes	%	tonnes	%	tonnes	%
SSO Processed	23,301	100	35,881	100	43,535	100
Biogas Produced	2,875	12.3	3,835	10.7	4,151	9.5
m3/tonne	123		107		95	

Increase in Annual Processing Capacity =>
Trade-off between Throughput and Biogas Production

Source: City of Toronto

Dufferin AD Plant - Operational Experience





Intermittent AD feeding causes daily and weekly variation in biogas production
=> Solution: Addition of Buffer Tank(s)

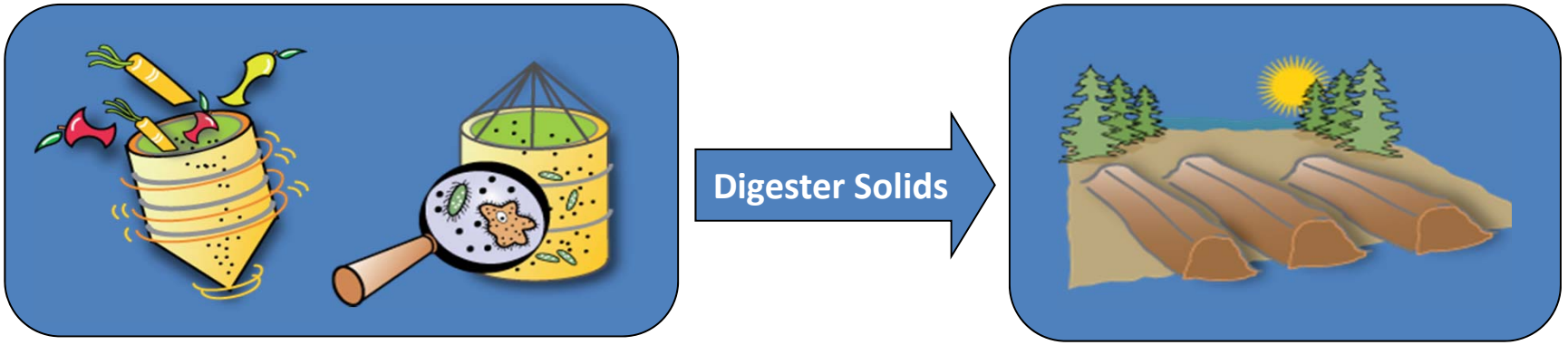
Source: City of Toronto

Green Bin Program - The Future

- **70% diversion goal requires SSO program expansion**
- **SSO tonnage to increase to ~180,000 MT/yr**
- **110,000 MT/yr City base capacity + 70,000 MT/yr private**

Primary Sites:
Pre-processing + AD
In-City, City-owned

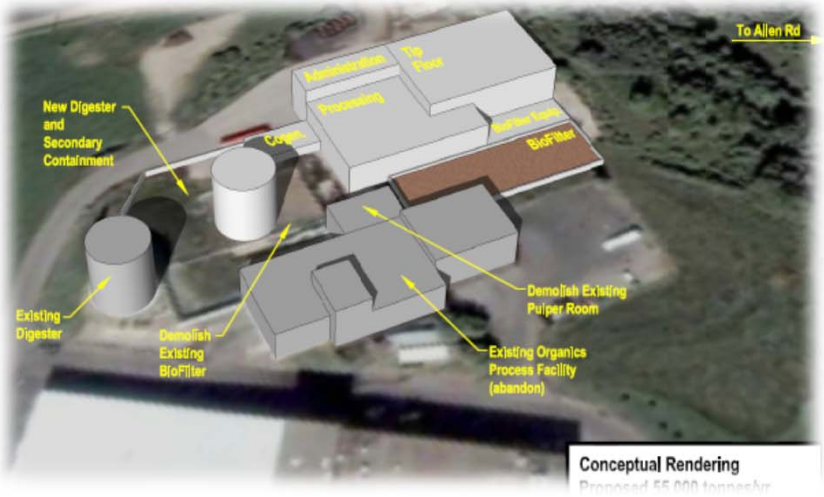
Secondary Site:
Composting External
(public or private)



- **2007 City Council approved construction of 2 AD facilities:**
  - **55,000 MT/yr at Dufferin Waste Management Facility**
  - **55,000 MT/yr (75,000 MT/yr max) at Disco Rd Transfer Station**

Source: City of Toronto

Future Expansion of Dufferin AD Facility



Phase 1:
New Digester & Biofilter

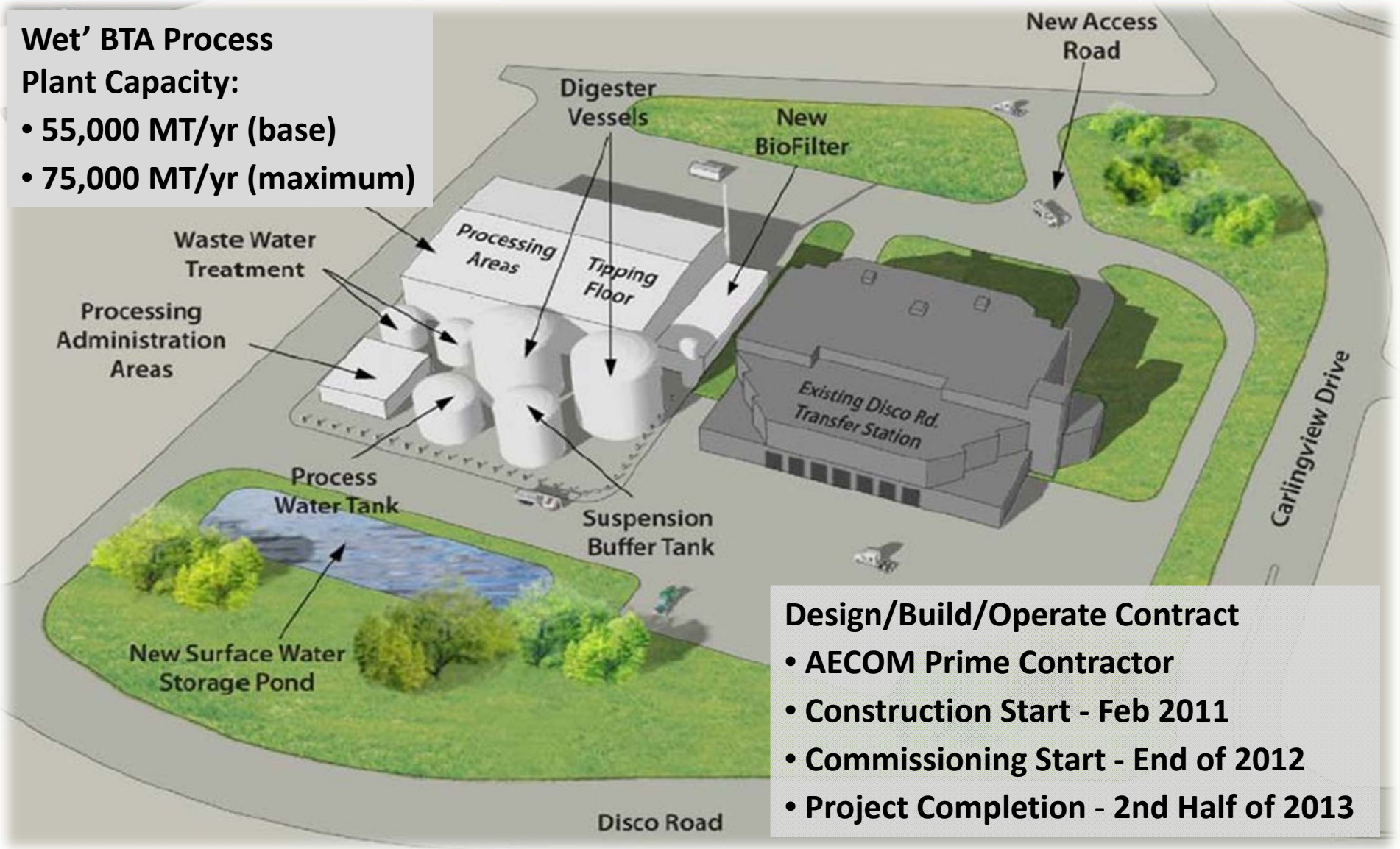
Phase 2:
Expansion of Tip Floor & Processing

Ultimate Capacity:
Up to 55,000 tonnes per year

Sources: City of Toronto; CCI-TNB

Disco Road Waste Transfer Station with New SSO Anaerobic Digestion Facility

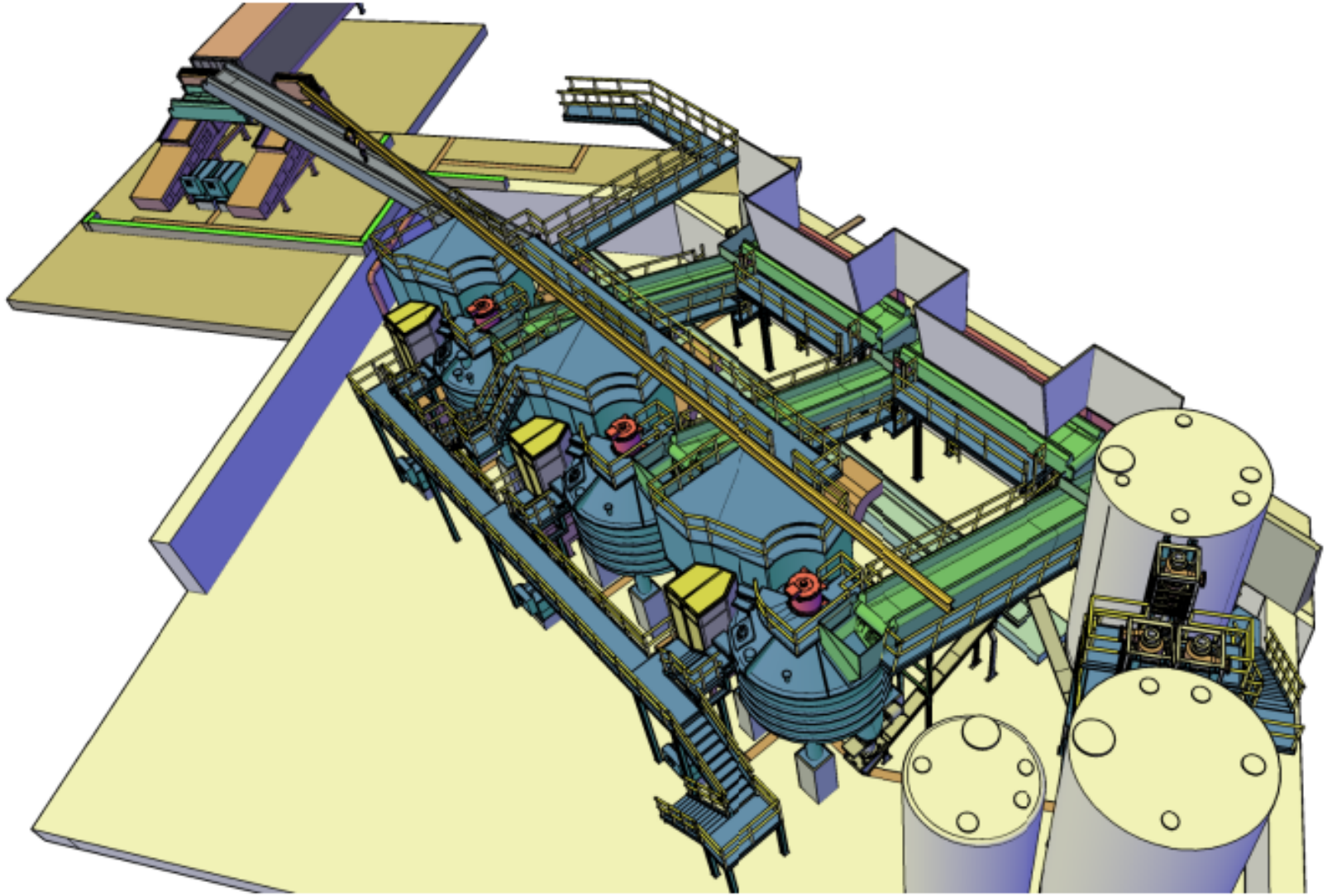
Wet' BTA Process
Plant Capacity:
- **55,000 MT/yr (base)**
- **75,000 MT/yr (maximum)**



Design/Build/Operate Contract
- **AECOM Prime Contractor**
- **Construction Start - Feb 2011**
- **Commissioning Start - End of 2012**
- **Project Completion - 2nd Half of 2013**

Source: City of Toronto

Toronto Disco Road SSO AD Facility
3-D Model, BTA Pre-treatment Process



Source: BTA International

Disco Road Waste Transfer Station – *Before Site Preparation & Construction* (Sept. 2010)

Source: AECOM

New Toronto Disco SSO AD Facility
under Construction – *General View* (May 2012)

Source: AECOM

New Toronto Disco SSO AD Facility under Construction – *Tank Farm* (May 2012)

Source: AECOM

New Toronto Disco SSO AD Facility
under Construction – *Hydropulpers & LF Presses*

Source: AECOM

New Toronto Disco SSO AD Facility under Construction – *Conveyor System* (May 2012)

Source: AECOM

New Toronto Disco SSO AD Facility
under Construction – *Residue Presses* (May 2012)

Source: AECOM

Biogas Utilization Plan: Biomethane + CNG Vehicles

Primary SSO Facilities
(110,000 tonnes per year SSO)

Biogas: 13.6M m^3/yr
60% CH_4

Biogas → **Biomethane Upgrading System**

Biomethane into NG Grid (7.8M m^3/yr)

2.5M m^3/yr → **City Buildings etc.**

5.3M m^3/yr → **New City-owned CNG Fueling Station**

CNG SWMS Collection Vehicles

Source: City of Toronto